THE PROPERTIES OF HANG SENG INDEX FUTURES

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ABSTRACT

Hang Seng Index (HSI) Futures has been listed in Hong Kong for six years. This project, through an empirical study, deals with various aspect of HSI futures.

The patterns of futures trading over last six years have been investigated in the study. The findings show that there are some changes in the trading patterns over time, but most changes occurred after the Crash. Investigation on spread trading in some particular periods suggested some specific properties of futures prices associate these events.

The indicators associated the futures trading, including gross open interest, net open interest and trading volume, are the main focus of this project. In general, these indicators seem unable to offer useful information for the trend of stock price. In some specific situation, such as "advancing" and "declining" market, however, they do provide extra, but limited, information for trading.

Hedge effectiveness, over all the years, is high. But in 1991, it deteriorated, although trading activity was picking up.

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CONTENTS

CHAPTER I: INTRODUCTION

On February 24, 1982, the Kansas City Board of Trade launched stock index futures, based on the Value Line Stock Index. For the first time, investors can trade futures contracts on stock index, although commodity futures have existed for over 100 years. Following the Kansas City Board of Trade, the Chicago Mercantile Exchange and the New York Futures Exchange introduced futures contracts based on Standard and Poors 500 Index and NYSE Composite Index in April 1982 and September 1983 respectively.

Successful introduction of stock indices futures in US push other countries and regions to consider develop their own stock futures. As an international financial centre, Hong Kong soon followed this trend. On May 6, 1986, Hang Seng Index futures began to trade at Hong Kong Futures Exchange (HKFE). The futures received warmly welcome by investors shortly after their inception. By the third quarter of 1987, the HSI futures became the second most active stock futures in the world, only next to the S & P futures. This picture discontinued after the Crash in 1987.

In the HKFE, currently, there are other four Hang Seng Sub-indices futures based on the indices of Commerce and Industry, Property, Utilities and Finance. However, trading activity on these futures are very insignificant. The trading volume usually

only one for each sub-index future.

Stock index futures provide a mechanism to the investors to adjust risk positions in their portfolios. Basically, there are three types of traders who enter futures contracts: hedgers, arbitrageurs and speculators. If investors hold stock and want to protect themselves against the risk of a fall in stocks value, they may sell future contracts. The falls in the value of the stocks will be offset by corresponding gains in the futures market. Of course, if the market does not come down, they will lose money on futures, which, however, will be offset by the increases in the value of stocks. This kind of investors is called hedgers. In the market allowing short selling in stocks, the opposite situation (short stock, and long futures) may happen to the hedgers. Speculators try to anticipate the trend of the stock market, and conduct matching transaction on the corresponding futures. For instance, if they believe the market will boom, they will buy the futures and vice versa. Speculators, of course, are prepared to take the risk of the opposite market movement to they expectation. Speculators can also try to make profit through foreseeing the trend of narrower or wider the spread of settlement prices of futures contracts with different delivery months. Arbitrageurs are traders who seek to exploit risk-free profit by taking advantage of sufficient large of spread of futures price and cash price.

Research Problems

In last decade, the properties of stock futures and futures market behaviour have been investigated extensively. The most important topics include: arbitrage opportunity, pricing of futures, hedge effectiveness, and market efficiency. The studies were based on different futures contract in various markets. Bradford Cornell and Kenneth R. French (1983) studied the price of the NYSE Composite Index Futures. They found that the future price was relatively low but such low price reflected the impact of taxes rather than market inefficiency. Michael H. Hopewell and Robert H. Terpstra (1988) examined the pricing of HSI futures and they suggested that HSI futures tended to sell at prices sufficiently above the level of the spot index to offer frequent opportunities for arbitrage profits, almost all of which, however, occurred before the stock crash. Swati Bhatt and Nusret Cakici (1990) concluded that S&P 500 index futures are priced overall, at a premium as opposed to a discount with respect to the theoretical price.

In this project, we try to analyze HSI futures from different perspectives. Firstly, the trading behaviour of HSI futures from 1986 to 1990 will be reviewed. The trend of volume, net open interest and gross open interest will be presented to see whether there are some useful information behind them or the impact of some particular events happened in the past. Secondly, we will put effort on the relationship among the change in spot price, future price, net open interest and gross open interest and trading volume. Through this investigation, we try to find

out whether some inconsistency with market efficiency occurs. Thirdly, we concentrate on some particular events, such as the Crash, Gulf War and June 4 event, to explore the possibility of taking profit through spread strategy. Fourthly, some rules to help trading will be given and tested. And finally, brief discussion on hedge effectiveness will be presented.

Research Methodology

The research is based on empirical study approach. A series of books and articles concerning stock futures market have been studied first. The articles were mainly selected from Journal of Futures Market, Security Journal and Journal of Financial Market.

The data of HSI futures, including settlement price, stock' cash index, trading volume, open interest were collected from the Hong Kong Futures Exchange, with the help of Dr. Robert H. Terpstra. These daily data from 1986 to 1991 were run using SPSS and LOTUS. For SPSS, correlation and regression methods are adopted in various parts of this project. From the computer-yielded results, a logical analysis is used to find out their implication. In the process of the project, interview with relevant persons in HKFE and Hong Kong Future Clearing Cooperation Ltd. was also conducted to clarify some problems.

CHAPTER II: HSI FUTURES AND TRADING PATTERN

(I) HSI Futures Specification

The contract terms of HSI futures are as following: [9]

Contract Size: The Hang Seng Index Futures times HK$50.

Quotation: Index Points

Minimum Fluctuation: One Index Point (HK$50)

Maximum Fluctuation: 300 points per trading session above or below the last closing quotation. No limit is imposed on the spot month.

Trading Hours: Two trading sessions -- 10:00-12:30, 14:30-15:45 local Hong Kong time.

Delivery Months: Spot month, the next calendar month, and the nest two calendar quarter months.

Last Trading Day: The business day preceding the last business day of the month.

Settlement Day: The first business day preceding after the last trading day.

Final Settlement Price: An average of quotations for the Hang Seng Index taken at five minute intervals during the last trading day rounded down to the nearest whole number.

Settlement Method: Cash.

Minimum Margin: HK$15,000 (subject to change)

Each business day, the related indicators of trading activities for each specific future contract are reported. Except for prices (settlement, open, close, high and low),

trading volume, gross open interest and net open interest are listed.

Delivery months listed above is the pattern of 1991 contracts. Over last six years, the pattern of delivery months have changed several times. Initially, delivery months were two consecutive months, including the spot month (From May 6 to May 23, 1986, contract on May and June were available). Shortly, on May 26, the delivery months were added to three consecutive months. This picture remained until the end of 1988. From January 1989 to the end of 1990, delivery months included four consecutive even months. For example, in March, contracts on April, June, August and October were traded, while in February, maturity months were February, April, June and August. From 1991 onward, the situation was changed again. For instance, In April, delivery months were April, May, June and September. The new pattern seems become closer to that in US, where futures contracts with three consecutive quarter months are traded.

(II) Trading Volume, Gross Open Interest and Net Open Interest

(i) Definitions

Trading volume is the number of contracts trading within the day among the brokers or members in the market. The trading activities of the clients within one broker or member is excluded for calculation of trading volume.

Open interest refers to the total number of unliquidated

bought or sold contracts (one side only). There are two ways of expressing open interest, namely, Gross Open Interest and Net Open Interest. Gross open interest refers to the sum of all the futures contracts that remain to be liquidated. It represents the sum of long (or short) position of all brokers or members. Net open interest refers to the sum of the net amount of futures contracts that remain to be liquidated. It stands for total net long (or net short) of all brokers and members.

The two indicators, gross open interest and net open interest, provide different information of market activity. Gross position in the market reflects the situation of transaction activities of brokers and individual clients, while net position offers the information of trading among brokers, regardless of position of individual clients.

There are also definitions of gross open interest and net open interest for each broker. A broker's gross open interest is the sum of his long and short position. A broker's net open interest is the net of his long and short position. By definition, the gross open interest of the market is the half of total of all brokers' gross open interest. Before the stock crash, the brokers' margin requirement is based on their net open interest. This calculation base was shifted to gross open interest after the Crash to protect the operation of the futures market.

To illustrate the definition, we assume the market has only

three brokers:

DAY 1:

	Broker A	Broker B	Broker C	The Market
Long	25	18	27	70
Short	15	12	43	70
Gross Open Interest	40	30	70	70
Net Open Interest	10 (long)	6 (long)	16(short)	16

The net open interest of the market is total net long or net short of all brokers' positions.

DAY 2:

Broker A sells 2 contracts to broker B, one for reverse trading and one for adding short position for the clients of broker A. The clients of Broker B add two long positions. The trading volume is 2 and the position is:

	Broker A	Broker B	Broker C	The Market
Long	24	20	27	71
Short	16	12	43	71
Gross Open Interest	40	32	70	71
Net Open Interest	8 (long)	8 (long)	16(short)	16

Day 3:

Two clients of broker A give the instruction to A, one closes one long contract and the other closes one short contract. The trading volume is 0, but the gross open interests of Broker A as well as the market are changed:

	Broker A	Broker B	Broker C	The Market
Long	23	20	27	70
Short	15	12	43	70
Gross Open Interest	38	32	70	70
Net Open Interest	8 (long)	8 (long)	16(short)	16

(ii) Behaviour

Trading volume of HSI futures was quite high from the beginning of the futures. The average daily volume exceeded 10,000 in February 1987. In the following months, the over-heated situation emerged. Many local citizens were involved in futures trading. There were reports indicating that tax-drivers and amahs were engaging in trading activity in the future market. By the September 1987, the average daily volume, 27,318, reached the peak. The volume plummeted after the stock crash. The average daily volume in November was only 2,247, or less than 10% of that in October. Worse, it continued to decline and from December 1987 onwards, the average daily trading volume remained the level of less than 1,000. This circumstance continued until January of 1989. On the yearly basis, average daily volume of 1988 is the lowest, reflecting the lack of confidence of traders

after the Crash. In 1989, it increased to 960, up 70% over 1988. But in 1990, no improvement of trading activity was witnessed. The recovery of futures market was recorded in the year of 1991, with average trading volume of 2,024, increasing 112% over the preceding year. The level of trading activity in 1991, however, was only equivalent to 40% of that in 1986.

Basically, there is no significant monthly fluctuation in average daily trading volume. One evident exception happened in August of 1990. The average daily trading volume of that month was 2,440, more than double of the yearly figure. This situation may be because a lot of traders entered the market in expecting high market volatility due to Iraq's invasion.

Other indicators, gross open interest and net open interest, showed almost the some pattern of volume in last six years. The details are listed in Table 2.1. in the next page.

The gross open interest and net open interest are highly correlated in the studied period, with the correlation coefficients of 0.93684. The regression equation is:

$$GO(t) = 842.396 + 1.861NO(t)$$

where GO(t) and NO(t) represent the gross open interest and net open interest at time t respectively.

(iii) Active Contracts

At each business day, the trading volumes of different delivery months contracts differ significantly. Usually, one

TABLE 2.1: INDICATORS OF FUTURES TRADING
(total contracts, average number for a trading day)

MONTH	GROSS OPEN	NET OPEN	VOLUME
8605	3205	1241	1635
8606	6723	2177	2003
8607	7118	3070	2819
8608	11758	4865	4115
8609	16066	6269	5628
8610	23983	7270	8829
8611	15917	9476	7709
8612	16782	9985	7202
8701	22631	13739	9757
8702	26037	15725	11143
8703	31863	18009	14699
8704	33783	20184	14554
8705	31464	19013	13952
8706	34545	19708	17050
8707	37882	22597	18283
8708	45682	24797	24169
8709	59783	30119	27318
8710	67066	30521	23506
8711	25086	9549	2247
8712	4692	1582	795
8801	1760	868	774
8802	1702	982	674
8803	1670	869	626
8804	2337	925	903
8805	2429	1047	785
8806	2163	791	653
8807	1858	701	448
8808	1531	759	378
8809	1580	691	359
8810	1627	693	489
8811	1727	715	472
8812	1651	458	296
8901	2095	741	573
8902	3455	1501	1110
8903	4344	2379	979
8904	4806	2778	1131
8905	4877	2133	1770
8906	3771	1236	1262
8907	2622	1072	812
8908	3481	1331	986
8909	2748	979	565
8910	3245	1216	1122
8911	2837	1204	608
8912	2667	1216	536

MONTH	GROSS OPEN	NET OPEN	VOLUME
9001	2544	1371	594
9002	3038	1502	859
9003	2670	1397	424
9004	2841	1633	478
9005	2322	1201	532
9006	2813	1342	630
9007	2777	1301	864
9008	4560	1526	2440
9009	4057	1690	1102
9010	4299	1769	1301
9011	4190	1724	956
9012	4959	1755	1138
9101	3885	1485	1235
9102	4966	2168	2084
9103	5058	2179	2035
9104	5474	2408	2402
9105	5710	2483	2791
9106	5412	2536	1944
9107	7204	3945	2626
9108	6268	2940	2343
9109	4494	2508	1259
9110	4643	2186	1752
9111	5359	2082	2236
9112	4887	2088	1447

YEAR	GROSS OPEN	NET OPEN	VOLUME
1986	12801	5588	5032
1987	34616	18623	14680
1988	1833	790	567
1989	3418	1480	960
1990	3420	1513	952
1991	5298	2429	2024

TABLE 2.2: NO. OF DAYS TO MATURITY WHEN THE CONTRACTS GAIN AND LOSE THEIR MOST ACTIVE POSITIONS

MONTH	GAIN	LOSE	MONTH	GAIN	LOSE
8606	8	39	8901	7	41
8607	12	41	8902	7	35
8608	8	41	8904	9	66
8609	6	40	8906	9	72
8610	9	37	8908	7	71
8611	9	37	8910	11	68
8612	14	42	8912	10	70
8701	13	42	9002	11	68
8702	10	43	9004	3	70
8703	12	42	9006	2	65
8704	13	42	9008	10	66
8705	14	42	9010	7	71
8706	12	46	9012	9	66
8707	9	43			
8708	9	37	9101	--	--
8709	13	42	9102	8	70
8710	0	43	9103	7	36
8711	0	28	9104	6	40
8712	1	33	9105	8	37
			9106	2	36
8801	1	30	9107	8	35
8802	1	30	9108	8	38
8803	2	34	9109	2	37
8804	1	31	9110	6	35
8805	3	33	9111	6	35
8806	1	33	9112	11	38
8807	1	30			
8808	6	34			
8809	2	36			
8810	4	31			
8811	5	35			
8812	7	35			

month contract is traded more actively than the others. Table 2.2 shows the numbers of days to expiration for each most active contract. The most active contracts are not always the current month contract, and the most active position of one particular month contracts often is unable to remain until the contracts mature. Instead, it will be replaced by other month contracts in some trading day. (the most active position is shifted).

Interestingly, the shift pattern does not remain constant over the last six years. The most significant change occurred after the stock crash. Before the Crash, the most active position of one delivery month contract usually was replaced by the following delivery month contract when it was 10 to 15 days to expiration (i.e. shift happened around 15th of the month). From October 1987 to July 1988, the current month contracts maintained as most active position until they almost expired. Particularly, October and November contracts were the most active ones in October and November respectively. The reason that investors tended to trade shorter contracts was the confidence to the market plummeted after the Crash. From August of 1988 onwards, shift time of most active contracts became earlier than immediately after the Crash. In general, however, even in 1991, shift time was not as early as the first three quarters of 1987. This is consistent to the fact that current trading activity has still not achieved the level of that in 1987.

Table 2.2 also indicates that, in 1989 and 1990, the number of days to expiration for the most active contract can be around

70. The reason is that only contracts with even month were traded in this period.

Not surprisingly, futures contracts with every one delivery month experienced a period of most active position. The only one exception is the contracts of January of 1991, which have never be most active, due to shift of the pattern of delivery months in January of 1991.

Usually, after one particular month contract recedes from the most active position, it will not regain such a position. However, there were some exceptions, which all happened after the Crash. For example, On April 18, 1989, the most active position of April contract was replaced by June contract, but next day, it became most active again. Such situation is believed to be just an coincidence and does not have significant meaning.

There is also a shift time in terms of net open interest. The shift time of net open interest is defined as the time from which onwards, the dominating position in terms of net open interest of one delivery month contracts will be replaced by other month contracts. The shift time of net open interest is usually not the same as that of trading volume. We may first write out the relationship of these two indicators:

$$NO(t) = NO(t-1) + V(t) - CL(t)$$

where V(t) represents the trading volume at time t, and CL(t) is the number of contracts which are closed during the day t.

TABLE 2.3: SHARE OF MOST AND NEXT ACTIVE CONTRACTS FOR INDICATO

	MOST ACTIVE			NEXT ACTIVE		
MONTH	GROSS OPEN	NET OPEN	VOLUME	GROSS OPEN	NET OPEN	VOLUME
8605	63.60	61.85	66.63	34.98	35.48	31.11
8606	69.66	61.87	69.33	25.89	30.22	24.94
8607	60.98	59.57	66.88	23.14	21.31	23.09
8608	60.01	53.95	65.59	33.88	35.40	30.22
8609	63.19	58.48	64.12	32.10	33.88	31.27
8610	63.75	58.31	69.06	33.79	37.78	28.65
8611	68.06	66.34	71.86	30.61	32.01	26.97
8612	68.54	67.97	68.03	27.87	27.53	29.22
8701	62.17	61.30	61.95	32.79	32.28	34.67
8702	53.65	46.06	61.38	35.94	39.19	31.99
8703	58.24	53.07	65.81	36.95	40.34	31.14
8704	66.65	64.06	67.55	31.04	33.09	30.31
8705	65.15	66.90	62.86	32.09	29.67	35.26
8706	64.62	64.45	62.81	32.90	32.43	35.35
8707	61.59	57.98	63.49	35.55	38.52	33.99
8708	57.00	51.16	65.67	35.00	37.12	30.56
8709	55.00	50.38	64.72	37.68	37.19	32.23
8710	53.57	32.16	64.04	38.35	52.40	32.54
8711	81.73	90.97	73.73	18.27	9.02	26.26
8712	89.71	85.77	87.41	10.29	14.23	12.59
8801	85.09	80.60	87.54	14.64	18.85	12.38
8802	85.77	86.47	89.34	14.22	13.50	10.62
8803	79.26	77.58	84.69	20.38	21.82	15.03
8804	76.75	74.06	80.65	23.25	25.94	19.35
8805	82.92	81.85	84.12	17.04	18.05	15.86
8806	85.94	81.80	83.36	14.06	18.20	16.64
8807	85.94	81.21	82.85	13.93	18.48	16.83
8808	80.44	77.67	79.53	19.41	22.03	20.17
8809	80.48	79.71	79.83	19.50	20.25	20.10
8810	73.80	70.63	76.36	25.11	27.90	23.06
8811	81.95	79.62	80.34	18.04	20.37	19.65
8812	81.94	74.82	81.21	17.99	24.96	18.76
8901	70.82	61.73	72.54	25.52	31.31	24.69
8902	69.70	64.54	71.49	29.02	33.07	26.77
8903	91.87	88.81	93.47	8.00	10.97	6.36
8904	71.75	71.39	68.95	27.69	27.77	30.92
8905	96.31	94.89	96.77	3.67	5.07	3.22
8906	69.59	67.75	82.87	30.37	32.15	17.09
8907	95.63	91.34	98.02	4.30	8.48	1.94
8908	77.95	75.60	80.89	21.89	24.01	19.05
8909	98.23	96.78	99.14	1.77	3.22	0.86
8910	76.42	72.02	77.94	23.57	27.96	22.04
8911	99.59	99.10	99.83	0.41	0.90	0.17
8912	76.00	77.40	76.93	24.00	22.60	23.07

TABLE 2.3: SHARE OF MOST AND NEXT ACTIVE CONTRACTS FOR INDICATO
(continued)

	MOST ACTIVE			NEXT ACTIVE		
MONTH/ YEAR	GROSS OPEN	NET OPEN	VOLUME	GROSS OPEN	NET OPEN	VOLUME
9001	99.15	98.62	99.36	0.95	1.54	0.74
9002	75.30	72.61	80.46	24.55	27.16	19.42
9003	99.46	99.07	99.57	0.53	0.89	0.70
9004	80.37	80.35	74.81	19.50	19.47	24.96
9005	99.22	98.90	99.57	0.93	1.29	0.81
9006	80.89	79.43	78.99	18.97	20.36	20.60
9007	95.53	95.25	97.65	5.04	5.19	2.69
9008	74.18	72.48	84.98	25.31	26.68	14.89
9009	97.55	96.27	98.51	2.74	3.96	2.13
9010	76.06	69.12	80.94	23.45	30.13	18.51
9011	97.77	96.65	97.79	2.64	3.87	2.84
9012	68.66	67.64	69.48	30.99	31.84	30.11
9101	90.11	87.40	96.64	8.61	10.39	2.16
9102	70.70	67.30	75.00	28.93	32.16	24.89
9103	73.86	73.36	77.84	25.59	25.42	22.15
9104	76.76	74.83	81.12	22.59	23.81	18.76
9105	80.15	77.85	83.92	19.59	21.80	16.03
9106	85.89	85.61	83.79	13.83	14.09	16.24
9107	68.67	65.09	79.56	30.69	34.08	20.28
9108	79.43	75.82	77.78	20.24	23.58	21.89
9109	80.96	82.18	79.41	18.13	16.76	20.15
9110	78.02	77.28	82.39	19.57	19.15	17.18
9111	76.79	71.53	80.82	22.98	27.96	19.24
9112	73.74	71.71	79.43	26.10	27.92	20.62
1986	64.84	62.09	68.09	30.78	31.76	28.46
1987	60.76	55.66	64.49	34.00	36.37	32.48
1988	81.79	79.19	83.00	18.04	20.52	16.87
1989	83.39	81.18	85.39	16.23	18.14	14.28
1990	85.76	85.11	87.52	14.19	14.77	12.48
1991	77.42	75.01	81.15	21.93	23.96	18.66

From above equation, we can develop that

$$NO(t,M) - NO(t,N) = [NO(t-1,M) - NO(t-1,N)] + [V(t,M) - V(t,N)] - [CL(t,M)-CL(t,N)].$$

where M, N denote most active and next active contracts respectively.

As long as CL(t,M) is sufficiently more than CL(t-1,M), NO(t,M) - NO(t,N) can be negative. Therefore, the most active contracts does not necessarily possess more net open interest than the other month contracts.

The relationship between the shift time of trading volume and that of net open interest changed after the Crash. Before the Crash, shift time of net open interest was usually about five days earlier than that of trading volume. In October of 1987, the shift time of net open interest, October 2, came especially early, indicating that traders tended to maintain longer contracts and close more current month contract.

Table 2.3 lists the share of most active and next active contracts for each month. The indicators include trading volume, gross open interest and net open interest. Again, we can classify the pattern as before and after the Crash.

Before the Crash, the most active contracts usually accounted for two third of trading volume, gross open and net open interest. The next active contracts were still rather actively traded. After the crash, the share of active contract

TABLE 2.4: TRADING ACTIVITY FOR DISTANT CONTRACT
(No. of days to mature: first trading vs. first available)

MONTH	FIRST AVAILABLE	FIRST TRADING	MONTH	FIRST AVAILABLE	FIRST TRADING
8605	23	23	8901	91	58
8606	52	52	8902	88	56
8607	65	65	8904	117	111
8608	86	86	8906	149	136
8609	91	91	8908	183	173
8610	91	91	8910	182	123
8611	89	89	8912	211	120
8612	91	91			
			9002	242	60
8701	88	88	9004	239	102
8702	88	88	9006	240	121
8703	89	89	9008	242	122
8704	88	88	9010	243	116
8705	89	89	9012	242	119
8706	90	90			
8707	91	91	9101	241	112
8708	88	88	9102	87	70
8709	91	91	9103	60	60
8710	90	90	9104	60	60
8711	88	88	9105	238	150
8712	91	91	9106	60	60
			9107	57	57
8801	89	89	9108	239	74
8802	87	57	9109	60	60
8803	90	78	9110	60	60
8804	88	62	9111	59	59
8805	91	67	9112	244	121
8806	90	60			
8807	90	59			
8808	91	56			
8809	91	66			
8810	89	58			
8811	90	62			
8812	90	90			

was often around 80% in terms of trading volume, gross open and net open position. This is also can be explained as investors likes to trade near contract after the Crash.

Again, October of 1987 is a particular month. While the trading volume of most active contract was twice as many as that of next active contracts, the average daily net open interest of most active contract 9814, was less than that of next active contract 15994. This is because the shift time of net open interest came especially early as stated above.

Currently, there are four delivery month contracts available for trading. But usually, no trading activity takes place for the distant contract. So it is interesting to know when the distant contracts began to traded. Table 2.4 gives the number of days to maturity for the contracts when it is first available and when there is trading activity (defined as there is positive volume at least two consecutive business days).

Before the Crash, every month contract listed in the market had positive trading volume. This picture discontinued after the Crash. For example, the contract with delivery month of February 1988, which began to be listed in the market at the end of November 1987, had not been traded until December 20, 1987. In 1988, contract usually received trading one month after it appeared in the market.

From 1989 onwards, the days to expiration of distant contract can be up to 240, but few contracts were traded when

they had more than 120 days to mature. There occasionally some trading activities for the distant contract with 60 to 120 days to expire, but the trading volume usually below 10, very inactive compared with the near contract. In 1991, we witnessed that trading volume grew substantial. The distant contract, however, had not received more attention than the previous years.

CHAPTER III: SPREAD TRADING

One of the trading strategies is spread trading. In this strategy, traders try to make profit through the change of the discrepancy of the prices of two different month contracts. we use the following example for illustration.

Day 1: The price of January and February contracts are 4,000 and 4,050 respectively. If the trader believe that the 50 point spread will be wider, he/she can sell one January contract, and at the same time, buy one February contract.

Day 2: The prices of two contracts grow to 4,010 and 4,110 respectively, representing 100 point difference. The trader now can close his long position in February contract and short position in January contract.

From January contract, he/she loses 10 points (4,010-4,000), or $500, but from February contract, he/she gains 60 points (4,110-4,050), or $3,000. The net profit of such transaction is $2,500. (We assume no transaction cost). If the price difference became narrower, say 10, the trader would lose $2,000.

If the price spread of two month contract were too wide, the spread of one month contract and cash price would create an arbitrage opportunity. Therefore, spread trading is less risky than just short or long futures. The loss of wrong estimation of

market can be locked in the certain level. Of course, one can not expect to achieve great return under this strategy.

The futures price of near contract is not necessarily below that of longer term contract. If traders hold pessimistic views towards to the future, the negative spread may happen. (We define spread as price of the longer term contract less that of shorter term contract)

Now we are going to look at some empirical data, which associated with some particular event in the past. The purpose is to see how these events caused the change in price spread of the futures contracts. We choose three typical events, the Crash in October 1987, June 4 event in 1989 and Iraq's invasion in August 1990. These three events had resulted in dramatic movement in Hong Kong stock market. We may make comparison of average five days spread for three periods: the five days period before the event, one to five days and six to ten days after the event.

	Period 1	Period 2	Period 3
The Crash	40.8	15.9	3.9
June 4 Event	46.1	23.0	-1.0
Iraq's Invasion	39.8	42.8	8.4

* For the Crash, several days were omitted. Period 2 and period 3 lag three days respectively compared with the definition. The reason of such treatment is that spread immediately after the Crash was extremely wide due to limitation of price change upon on the futures contract except cash month contract.

The spread tends to became narrower and narrower over three period for the first two events. For the third event, the spread of period 3 was significant smaller than that of period 2. These phenomena mirrored the confidence towards future market movement was hurt by the events. Under such situation, one may consider the following trading strategy after the some particular events causing market plummets.

In the first few days after the event, traders may long the current month contract and short the next delivery month contract. And in the following several days, they close their long and short position. The scenario here is exactly oppositive as the example at the beginning of this Chapter.

One may suspected that the narrower spread may due to the declining of stock price, which may also associated the lack of confidence to the market. In these three particular events, however, this conclusion is untrue.

	Period 1	Period 2	Period 3
The Crash	2751.94	2235.31	2351.16
June 4 Event	3839.55	2107.13	2121.27
Iraq's Invasion	3424.93	3090.93	3120.92

The above figures are the average 5 days close price for three period. Actually, the average price of period 3 increased compared to the period 2.

CHAPTER IV: RELATIONSHIP BETWEEN CHANGE IN PRICE AND CHANGE IN MARKET INDICATORS

In the efficient market, change in stock price of one day does not render any information for the price change in the following days. Similarly, the price change in futures market cannot convey the knowledge of the spot price in the near future under the assumption of market efficiency.

For different periods, correlation coefficients between change (relative change) in spot price (close index in the stock market) and futures price (settlement price for the most active future contract) are calculated and provided as following. The changes in futures prices are lagged one to five trading days.

No. of days lag	1986	1987	1988	1989	1990	1991
1	0.149	0.051	0.155	-0.078	0.129	0.017
2	0.025	-0.093	0.060	-0.131	-0.055	0.022
3	-0.010	0.149	-0.047	0.100	0.110	-0.152
4	0.099	0.076	0.018	-0.057	-0.061	0.025
5	-0.083	0.041	-0.097	-0.067	-0.058	0.045

The coefficients are very low, most of which are below 0.10. The ceilings in absolute value is only 0.155. Two tail test

suggests that all correlations are insignificant at the level of 0.05. This phenomenon is consistent with the market efficiency assumptions.

Correlations between the spot price change and the changes in other market indicators are also computed. The table 4.1 shows the details of correlation coefficients. Again, one to five days lagged data are all considered. The level of all correlation is also quite low, and only few of coefficients show significant at the level of 0.05. Such significance all happens in some particular years, and is believed as coincidence. Actually, the coefficients over the entire period (1986 to 1991) are extremely low. None exceeds 0.05 and all are statistically insignificant.

We thus can conclude that all of market indicators of futures, futures price, gross open interest, net open interest and trading volume, in general, are unable to signal the trend of price in the stock market.

TABLE 4.1: CORRELATION COEFFICIENTS
(Change in spot price vs change in open interest and volume)

LAG DAYS	1986	1987	1988	1989	1990	1991	86-91
			(Spot price vs Gross open interest)				
1	0.014	0.075	-0.028	-0.083	-0.047	0.045	0.015
2	0.110	0.037	0.049	-0.013	-0.113	0.143	0.044
3	0.021	-0.030	0.029	0.053	-0.006	0.032	0.011
4	0.000	0.005	0.169@	0.051	0.130	-0.041	-0.001
5	-0.175	0.109	-0.014	0.106	0.036	0.044	0.022
			(Spot price vs Net open interest)				
1	0.046	0.020	-0.001	-0.050	-0.032	0.002	-0.011
2	-0.050	-0.006	-0.015	-0.033	0.017	0.157@	0.023
3	0.196@	-0.035	0.119	-0.085	-0.046	-0.016	-0.015
4	-0.157	0.024	0.033	-0.041	-0.049	0.023	-0.010
5	0.117	0.029	0.066	-0.108	-0.052	0.001	-0.011
			(Spot price vs Trading volume)				
1	-0.168	-0.071	0.093	-0.009	0.122	0.104	0.004
2	-0.046	0.056	-0.071	0.052	0.049	-0.092	0.016
3	0.052	-0.008	0.005	-0.026	0.007	0.178@	0.008
4	0.073	0.102	-0.097	0.049	0.023	-0.021	0.031
5	-0.033	-0.011	0.135	-0.001	0.033	-0.099	-0.001

@ significant at level 0.10

CHAPTER V: TRADING BASED ON FUTURES MARKET INDICATORS

In the last chapter, we suggest that the futures market indicators, generally, cannot render useful information for the price trend of the stock price. However, further investigation of open interest and trading volume reveals that these indicators, in some particular circumstances, may reflect the behaviour of traders in the market. The traders' expectations, more or less, would hint the price trend. Basically, there are two scenarios: [8]

1. Increase in open interest in an advancing market indicates that the buyers are the dominant force in the market. If the trading volume is also very high, this implies that the buyers are urgently buying the market. Thus, the validity of the uptrend can be confirmed.

2. Similarly, increase in open interest in a declining market indicates that the sellers are in control. If the trading volume goes up, this implies that the sellers are urgently selling the market. Thus, we can confirm that the market must be very bearish.

Based on these two assertions, we are going to set up some rules to foretell the market movement in the future.

Obviously, there is a need to define "advancing" and "declining" market. For the sake of convenience, the change in 5-day moving average of spot price is adopted as an indicator to represent the general market movement.

Specifically, let S(t) be the spot price at time t. Define

$$AS(t) = \{ S(t-4) + S(t-3) + S(t-2) + S(t-1) + S(t) \} /5. \quad [5.1]$$

$$CAS(t) = \{ AS(t) - AS(t-1) \} / AS(t-1). \quad [5.2]$$

If CAS(t) > 0.5%, the market is called as "advancing" at the time t. Similarly, if CAS(t) < -0.5%, it is in a "declining" stage.

This definition emphasizes the price change over a few days rather than price change in one particular day. The moving average is adopted to measure the price level in order to moderate the some daily fluctuation effect. 0.5% critical level is set up for highlighting the significance of price level change in order to claim the market is in the "advancing" or "declining" stages. By the definition, even though in some specific trading day, the price decreases compared with the previous trading day, the market on that day may still be considered as "advancing". This phenomenon, however, cannot harm the rationality of the definition. We now further investigate the meaning of "advancing" and "declining" under the foregoing definition.

In an advancing market, from equations [5.1] and [5.2], we can obtain:

$$S(t) - S(t-5) > 0.005 \{S(t-5) + S(t-4) + S(t-3) + S(t-2) + S(t-1)\}$$

or,

$S(t) - S(t-5) > 0.025AS(t-1)$.

Hence, the advancing market means that, compared with the close price 5 trading days ago, the current price is at least 2.5% of previous moving average price more. For example, if AS(t-1) is 4,000, then advancing market suggest that current close price at least has grown 100 point within 5 trading days. The analysis indicates our definitions make sense.

In the declining market, similarly,

$S(t) - S(t-5) < -0.025AS(t-1)$.

The reason we choose "five days" to take average is the number of trading days in one week usually is five. The advancing or declining thus reflects the price change in one week.

According the two assertion at the beginning of this chapter, we now develop some rules to predict the price level in the near future.

Let CGO(t), CNO(t), and CV(t) represent the change in gross open interest, net open interest and trading volume in the whole market at time t, respectively. That is,

$CGO(t) = \{GO(t) - GO(t-1)\} / GO(t-1)$

$CNO(t) = \{NO(t) - NO(t-1)\} / NO(t-1)$

$$CV(t) = \{V(t) - V(t-1)\} / V(t-1)$$

Rule 1: In the advancing market (when CAS(t) > 0.5%), if CNO(t)>0 and CV(t)>0, then the average close price of next five days would be higher than current moving average price, i.e. AS(t+5) > AS(t).

In the declining market (when CAS(t) < -0.5%), if CNO(t)>0 and CV(t)>0, then AS(t+5) < AS(t).

To measure the accuracy of this rule, the empirical data from 1986 to 1991 are adopted to test the performance. The result is shown as follows:

YEAR	TOTAL OBSERVATION	CORRECT PREDICT	ACCOUNT FOR (%)	WRONG PREDICT	ACCOUNT FOR (%)
1986	21	19	90.5	2	9.5
1987	31	29	93.5	2	6.5
1988	23	20	87.0	3	13.0
1989	26	15	57.7	11	42.3
1990	21	18	85.7	3	14.3
1991	20	18	90.0	2	10.0
86-91	142	119	83.8	23	16.2
86-91 exclude 89	116	104	89.7	12	10.3

Overall, the number of cases of correct prediction accounts for 83.8% of total observation. 1987 shows the best performance with 93.5% of correct forecasting, while 1989 is the worst, only 57.7% of observations being correctly foretold. If the year 1989

is excluded from the consideration, the overall accuracy grows to 89.7%.

It seems that the rule is a good mechanism to predict the stock price trend. One may suspect that whether the net open interest and trading volume render information to increase the accuracy of forecasting, because, in the last chapter, the correlation coefficients between price change and changes in open interest and volume with one to five days lagged is extremely low. To answer this question, we eliminate the net open interest and trading volume from Rule 1, and yield Rule 2:

Rule 2: If CAS(t) > 0.5%, then AS(t+5) > AS(t).

If CAS(t) < -0.5%, then AS(t+5) < AS(t).

The empirical test offers the performance of Rule 2:

YEAR	TOTAL OBSERVATION	CORRECT PREDICT	ACCOUNT FOR (%)	WRONG PREDICT	ACCOUNT FOR (%)
1986	57	48	84.2	9	15.8
1987	84	69	82.1	15	17.9
1988	79	63	79.7	16	20.3
1989	96	75	78.1	21	21.9
1990	79	65	82.3	14	17.7
1991	68	58	85.3	10	14.7
86-91	463	378	81.6	85	18.4
86-91 exclude 89	367	303	82.6	64	17.4

Compared with the Rule 2, Rule 1 has better performance in

all years, except 1989. For the entire period, information of net open interest and trading volume causes the accuracy up 2.2%, providing a marginal improvement. If the year 1989, is excluded, the improvement is more pronounced with 7.1% of accuracy.

As stated in the early chapter, there exists a positive relationship between the gross open interest and net open interest. Hence, the net open interest in Rule 1 may be replaced by gross open interest. This leads to Rule 3:

Rule 3: If CAS(t) > 0.5%, CGO(t) > 0 and CV(t) > 0,
then AS(t+5) > AS(t).
If CAS(t) < -0.5%, CGO(t) > 0 and CV(t) > 0,
then AS(t+5) < AS(t).

Similarly, we can produce the performance table for Rule 3:

YEAR	TOTAL OBSERVATION	CORRECT PREDICT	ACCOUNT FOR (%)	WRONG PREDICT	ACCOUNT FOR (%)
1986	26	22	84.6	4	15.4
1987	46	40	87.0	6	13.0
1988	35	30	85.7	5	14.3
1989	24	16	66.7	8	33.3
1990	32	27	84.3	5	15.7
1991	32	31	96.9	1	3.10
86-91	195	166	85.1	29	14.9
86-91 exclude 89	171	150	87.7	21	12.3

While in the years 1989 and 1991, Rule 3 is better than Rule

1, in the remaining years, Rule 1 is more satisfactory. Overall, Rule 3 over performs slightly Rule 1, but if the year 1989 is excluded, Rule 1 provides better criterion for forecasting.

Both Rule 1 and Rule 3 present better yardstick than Rule 2. The indicators in the futures market, therefore, do offer extra information for foreseeing price trend in the stock market under some particular situations, although such information may only contribute limited improvement.

The seemingly contradiction occurs. In the last chapter, we claim that, general, open interest and trading volume do not provide information for future price movement, which is supported by low and insignificant correlation coefficients. One the other hand, however, Rule 1 and Rule 3 exhibit that open interest and trading volume are able to perform positively in price trend prediction. There are two explanation for this problem.

Firstly, Rule 1 and Rule 3 are only useful for some particularly trading days. To utilize the rules, the market should be in the stage of either "advancing" or declining", and open interest and trading volume should meet some requirement. The number of total applicable cases in the two rules are only 142 and 195, accounting for 10% and 13.7% of number of total trading days in the entire period respectively. Therefore, the open interest and trading volume are far beyond to hint general price trend in the future.

Secondly, Rule 1 and Rule 3 only suggest the ups and downs in the average price. They do not give the magnitude of price change. On the other hand, correlation mirrored the linear relationship between the two variable concerned. So, there is no inconsistency between the results of two chapters.

In the following section, a regression approach is adopted to test the rules. Correspondingly, the dependent variable here is the change in average of next five-day price, over the current moving average price. That is

CAS(t+5,5) = {AS(t+5)-AS(t)}/AS(t).

Rule set up early suggest that there is a need to consider the interaction effect of open interest, trading volume and change in price level. Thus the independent variables include CNO(t), CV(t), CAS(t), CNO(t)*CV(t), CNO(t)*CAS(t), CV(t)*CAS(t), and CNO(t)*CV(t)*CAS(t). The stepwise regression method provide the following equation

CAS(t+5,5) =

0.04331+1.91125CAS(t)+0.09717CNO(t)*CAS(t)+0.00038CNO(t)*CV(t)
(0.0324) (18.216) (7.136) (1.971)

The data in parentheses are t-value. The squared R in the regression is 0.67285. However, when we use only CAS(t) as the independent variable to conduct regression, the squared R is 0.65632. Therefore, statistically, change in net open interest and trading volume do contribute significantly the forecasting of market movement. But such contribution is quite small compared with the change in previous moving average price. This

result is consistent with the previous findings.

If the net open interest is replaced by gross open interest, the similar results yielded. The regression equation becomes:

$$CAS(t+5,t) =$$

$$\underset{(0.984)}{0.12975}+\underset{(26.834)}{1.48885}CAS(t)+\underset{(8.321)}{0.05034}CGO(t)*CAS(t)\ \underset{(-7.482)}{0.00573}CV(t)*CAS(t)$$

The squared R is 0.6784, compared with 0.65632 when the independent variable include CAS alone.

The rules offer the information of whether average price of next five trading days is up or down compared with the current average price level, but they do not suggest how much the price will be changed. This is the main limitation of these rules.

Of course, we may use regression equation to determine the magnitude of price changes. Unfortunately, the regression result show unsatisfactory forecasting performance because squared R is only about 0.67.

CHAPTER VI: HEDGE EFFECTIVENESS

The simple way to measure the hedge effectiveness of futures, according to Ederington (1979) is to calculate the correlation coefficient between the change (absolute change) in spot price and that of futures. The high correlation is associated with high effectiveness of hedge using futures.

The correlation coefficients are computed accordingly for HSI futures. For the futures price, the most active contracts are adopted. The following is the results for different years.

YEAR	1986	1987	1988	1989	1990	1991	86-91
COE.	0.8851	0.9532	0.9223	0.9708	0.9251	0.8682	0.9355

The correlation is quite high in all years. Overall, high correlation coefficient, 0.93955, suggest the hedge effectiveness of HSI futures is also high.

On the yearly basis, 1987 to 1990 showed higher correlation than 1986, the year of the birth of HSI futures. This picture suggest that the effectiveness was improved after a period of market operation. However, in 1991, the deterioration on such effectiveness was witness, although the trading on futures was picking up in this year.

In the following section, the regression is again used to

see the relationship of two changes:

$S(t)-S(t-1) = a + b(F(t)-F(t-1))$

where S(t) and F(t) stand for the spot price and the futures price of the most active contract at time t. If time t is the shift day, F(t-1) refers to the price of the same contract as F(t).

The results are as following:

Year	a	b
1986	0.6369 (0.762)	0.8216 (24.135)
1987	-0.1849 (-0.109)	0.7335 (18.572)
1988	0.3043 (0.459)	0.7654 (37.443)
1989	0.0233 (0.025)	0.8289 (63.219)
1990	0.5151 (0.578)	0.8484 (38.217)
1991	0.2542 (0.180)	0.8954 (27.441)
1986-1991	0.3871 (0.800)	0.7787 (102.554)

The value of b, the determinant of the hedge ratio, changes over time, suggesting that different period may have to use different hedge ratios to achieve the same hedge effect.

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